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Cover: Saddled leaf-nosed snake, *Phyllorhynchus browni*, from the municipality of Hermosillo, Sonora, Mexico. Photograph by Ian Recchio.

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Notes on Mexican Herpetofauna 22: Herpetofauna of the Continental Portion of the Municipality of Hermosillo, Sonora, Mexico

Manuel Nevárez-de los Reyes^{1*}, David Lazcano¹, Javier Banda-Leal¹ and Ian Recchio²

Abstract

We determined the herpetofauna of the continental portion of the municipality of Hermosillo, Sonora, Mexico. We conducted a series of field trips within the study area, complemented with a review of the literature and an examination of the specimens deposited in the collections of the Centro Ecológico de Sonora and the Herpetological Laboratory of the Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León. We found that the herpetofauna of the municipality consists of at least 61 species from 48 genera and 26 families: 11 anurans, 19 lizards, 26 snakes and 5 turtles. We also found morphological variations not previously reported in some species, e.g., *Smilisca fodiens*, *Rena humilis*, *Coluber bilineatus*, *Coluber flagellum cingulum*, *Phyllorhynchus decurtatus*, *Crotalus molossus molossus* and *Micruroides euryxanthus*. There is evidence of an intergradation zone between *Micruroides euryxanthus australis* and *Micruroides euryxanthus euryxanthus*. Considering geographical affinity (compared with the state richness) of the 61 total species recorded for the municipality (175 for the state) 24 (37) are properly Sonoran, 13 (25) generalist, 11 (49) tropical, 10 (13) generalists to North American Deserts, 2 (5) to the American Great Plains and 1 (5) introduced or invasive. There are no records for species with Madrean (31) Chihuahuan (9) or eastern temperate (1) affinities in the municipality.

Resumen

Se realizó un estudio para conocer la composición de la herpetofauna de la porción continental del municipio de Hermosillo, Sonora, México; para lograr esto, se llevaron a cabo una serie de colectas dentro del área de estudio, complementándose con el examen de los ejemplares de éste municipio depositados en las colecciones herpetológicas del Centro Ecológico de Sonora y la Universidad Autónoma de Nuevo León, además de revisión de literatura. Se encontró, que al grado actual de conocimiento, la herpetofauna del municipio está compuesta por 26 familias, 48 géneros y al menos 61 especies; de los cuales, 11 son anuros, 19 son lacertilios, 26 son ofidios y 5 son quelonios. Se encontraron variaciones no reportadas en la morfología de las especies *Smilisca fodiens*, *Rena humilis*, *Coluber bilineatus*, *Coluber flagellum cingulum*, *Phyllorhynchus decurtatus*, *Crotalus molossus molossus* and *Micruroides euryxanthus*. Se presenta evidencia de una zona de intergradación entre *Micruroides euryxanthus australis* y *Micruroides euryxanthus euryxanthus*. En cuanto a su afinidad geográfica y comparándola con el estado de Sonora, del total de 61 especies registradas para el municipio (175 para el estado) 24 (37) son propiamente sonorenses, 13(25) generalistas, 11 (49) tropicales, 10 (13) generalistas de desiertos norteamericanos, 2 (5) de las grandes planicies y 1 (5) introducida. En el municipio no se registran especies de afinidad madreña (31) chihuahuense (9) ni templada del este (1) que si ocurren en el estado.

Introduction

Mexico is considered one of the most biologically diverse countries, although more than 52% of its territory is classified as arid or semi-arid (Schmidt, 1989). It is estimated that it possess 10% of known extant species (Ceballos, 1993). This richness is particularly emphasized in vertebrate fauna, since Mexico harbors the largest number of reptile species, and ranks third in amphibian species (Toledo, 1988). It is also relevant that 61% of the amphibians and 53% of reptiles are endemic, altogether giving a national herpetofauna a 55.7% of endemism (Flores-Villela, 1993a) in addition to the relatively frequent discovery of new undescribed species.

Despite Mexico's high biological diversity, most of the research in this field has been conducted by foreign specialists, basically North Americans, a selective group English's, German and French researchers (Flores-Villela and Nieto, 1989). These authors have pointed out the lack of Mexican specialists in herpetological taxonomy.

This study was motivated by the scarcity of local herpetofaunistic studies, which was obvious when consulting distribution maps of species that inhabit both Mexico and the United States of America. The maps from the United States are updated based on a large body of comprehensive records; on the Mexican side distribution maps are uncommon, and the majority of

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the records come from localities along state and federal roads, resulting in a distorted assessment of the geographic distribution of these species. Inventories are useful when there is a need for information of the biodiversity of a particular area; the municipality of Hermosillo has several species listed as rare, threatened, endangered and subject to special protection by SEMARNAT (2010). This list allows us to understand which species are present in the region, and can be used to protect key areas. Unfortunately this issue has enormous political connotations, but spite of the negative political consequences, there is a need to increase surveys, not just for the herpetofauna, but all vertebrates.

Below we cite some of the most important articles published for the state since the 1930s.

Allen (1933) reported 24 species of amphibians and reptiles, mainly collected between Guaymas and Hermosillo, in addition to describing a new subspecies of lizard, *Dipsosaurus dorsalis sonoriensis*. Linsdale (1933) recorded the presence of *Phyllorhynchus decurtatus browni*, in the town of Alamo Muerto in the municipality of Caborca, and Taylor (1936) analyzed the ecological relations of the herpetofauna collected in the municipalities of Hermosillo and Guaymas, in addition described *Cnemidophorus burti*, and reviewed all documentation of herpetological studies for the state until that date, featuring an abundance of literature on the field.

During the 1940s, Bogert and Dorson (1942) described *Callisaurus draconoides brevipes*, from a locality in the town of Alamos, in the municipality of the same name. In 1945, Bogert and Oliver reported 124 species for the state, assuming the presence of another 35 to 40 species. They also discussed biogeographic aspects of the state's herpetofauna and recognized its high diversity due to its geographic location within the country.

During the 1950s, Cliff's observations (1953) extended the range for *Eumeces obsoletus* and *Phrynosoma platyrhinos* to the north of the state. Langebartel and Smith (1954) reported 33 species and subspecies of amphibians and reptiles, the result of a month of collecting, mainly in the southern portion of the state. Lowe and Woodin (1954) described the subspecies *Masticophis flagellum cingulum*, based on specimens collected in Pima and Santa Cruz counties in Arizona, United State of America, and the municipality of Moctezuma, Sonora, Mexico. Savage (1954) registered range extensions for *Bufo cognatus*, *B. alvarius* and *Pternohyla fodiens* for the state. Zweifel and Norris (1955) reported a total of 10 species of amphibians and 48 species of reptiles (17 lizards, 27 snakes and 4 turtles) in the state, including descriptions of *Lampropeltis getulus nigrilus* and *Micruroides euryxanthus australis*. Smith and Hensley (1958) recognized the presences of 3 species of amphibians, 13 lizards and 13 snakes, in the region of "El Pinacate" — a huge herpetological diversity for the protected area.

Dixon et al. (1962) reported that the Navojoa region is an intergradation zone between two races of *Trimorphodon biscutatus lambda* and *Trimorphodon biscutatus vikinsonii*. Greer (1963) discussed zoogeographic aspects of the glossy snake *Arizona elegans noctivaga*, based on their presence in the municipality of Guaymas. McCoy (1964) recorded the presence of *Phyllorhynchus decurtatus norrisi* for a locality south of

Hermosillo. Smith and Taylor (1966) reported the total species of amphibians and reptiles known for the state, counting 21 anurans, 54 lizards, 62 snakes and 7 turtles, some of these species were reported for the municipality of Hermosillo. Lowe et al. (1968) described the salamander *Pseudoeurycea belli sierrae occidentalis* from a town near the municipality of Yécora.

In the 1980s, Berry and Legler (1980) described the turtle *Kinosternon alamosae* from specimens collected in the municipality of Alamos. Minnich (1980) reported *Phyllodactylus homolepidurus* from Punta Cirio, near Puerto Libertad in the municipality of Pitiquito, as the most northern locality for this species in the coastal portion of the state. Julia-Zertuche (1981) working on an assemblage of Mexican poisonous reptiles, mentioned those that occur in the state. Ottley (1981a, b) reported *Heloderma horridum exasperatum* for Movas in the municipality of Rosario, in the southern part of the state and *H. s. suspectum* near Alamos, indicating that their ranges overlap. Baltosser (1982) reported the most northern locality for *Boa constrictor imperator*, in the municipality of Arizpe. Ottley (1982) recorded *Trimorphodon upsilon* (= *biscutatus*) near Caborca. *T. upsilon*, along with other subtropical species, can be represented as relict populations within the Sonoran Desert. Perrill (1983) mentioned the presence of *Phrynosoma ditmarsii* near Tonichi, in the municipality of Soyopa. This is the first record of this species in the Yaqui River Basin (previously Rio Sonora Basin). Buskirk (1984) reported *Gopherus agassizii* in the Ejido El Sabino, on the road between Nuri and Esperanza, in the municipality of Rosario, in southern Sonora. Murphy and Ottley (1984) analyzed the distribution of herpetofauna on the islands in the Gulf of California, some of which are part of the state. Stebbins's (1985) guide to the herpetofauna of the western United States and Baja California presents distribution maps that comprise the state. Lara-Góngora (1986) discussed the relation between *Sceloporus grammicus microlepidotus* and *S. g. disparilis* comparing specimens collected in localities near Yécora; he also mentions the most common herpetofaunal species found in that locality. Varela-Romero et al. (1987) reported the salamander *Ambystoma tigrinum*, near the town of Sasabe in the municipality of Saric, disagreeing with previous reports for this species in Sonora, based on *Ambystoma rosaceum* specimens. Quijada-Mascareñas (1988) reported the frog *Pachymedusa dacnicolor* in riparian communities from the Sonoran Desert, near Ciudad Obregón. González-Romero and Alvarez-Cardenas (1989) conducted an inventory of the herpetofauna in the region of El Pinacate huge biological reserve for the state, and noted the existence of 45 species. They also analyzed the ecological relationship of the 25 most common species. Ramírez-Bautista et al. (1989) recorded *Trimorphodon biscutatus lambda* for Isla Tiburón, in the municipality of Hermosillo.

In the 1990s, there were two new reports for Tonichi, in the municipality of Soyopa: *Drymarchon corais rubida* (Quijada-Mascareñas et al., 1990) and *Sonora aemula* (Nevárez-de los Reyes and Parra-Salazar, 1990). Mellink (1992) documented the presence of *Thamnophis cyrtopsis* in the extreme west portion of state near the municipality of Caborca. Grismer (1996) reported to *Lampropeltis getula nigrila* from the island of San Pedro Nolasco in the municipality of Guaymas.

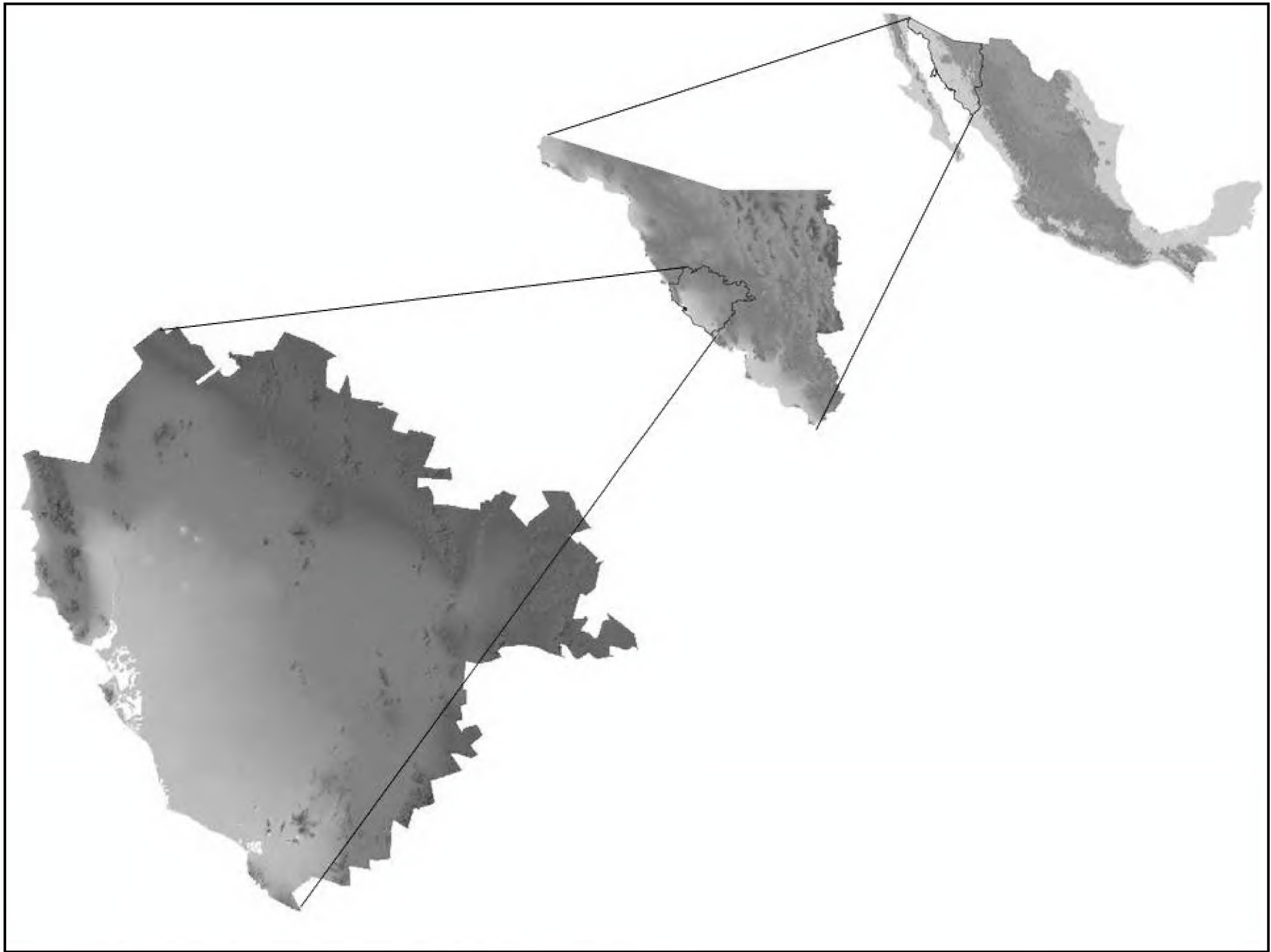


Figure 1. Location of the municipality of Hermosillo in Sonora, Mexico.

Flores-Villela and Pérez-Mendoza (2006) completed an inventory of herpetofauna for each state of Mexico, but they only reference four articles for the state of Sonora, and do not mention many of the above. Quijada-Mascareñas and Enderson (2007) recorded the presence of *Ramphotyphlops braminus*, the first report for this invasive species for the municipality of Hermosillo. Quijada-Mascareñas et al. (2007) mention *Plestiodon obsoletus* for Hermosillo, a transition between Sonoran Desert and Sinaloan Scrubland. Bezy et al. (2008) described *Xantusia jaycolei* for the San Ignacio River mouth, in the municipality of Hermosillo, a population that had previously been considered as *X. vigilis*. Enderson et al. (2009) analyzed the diversity and richness of Sonoran herpetofauna, comparing it with surrounding states. They concluded that this state has the highest biodiversity, with a total of 187 species of the 402 present in all surrounding states, which comprise mainly of those with tropical affinity, Sonoran, Madrean, and generalists.

Study Site

The municipality of Hermosillo, Sonora, Mexico, has an area of 14,880.21 km², representing 8.7% of the state's surface. Hermosillo lies between 28°14' and 29°43' N and between 110°23' and 112°15' W, in the center of the state. It borders to the north with the municipalities of Pitiquito, Carbó and San Miguel de Horcasitas; to the east with San Miguel de Horcasitas, Ures, Mazatán, La Colorada and Guaymas; to the south with Guaymas and the Gulf of California, and to the west with the Gulf of

California and the municipality of Pitiquito (INEGI, 1998).

Hermosillo is nearly flat, tilted toward the west, ending at sea level. Plains are interrupted by mountains and hills that manage to reach 1060 m. Among these orographic structures are: Libre, Santa Teresa, Gorguz, Tepoca, La Palma, Siete Cerros, Bacoachito, Tonuco, Lopez, Batamonte, Johnson, El Carnero, El Tordillo, Las Trancas, Picachos, Las Tinajas, El Aguaje, El Ranchito, Iglesia Vieja, Molino de Camón, La Campana and La Labor (INEGI, 1998). According to INEGI (1998) the municipality of Hermosillo is located within the Sonoran Plain Province in the subprovince of Sierras and Sonoran Plains.

The Sonora River enters Hermosillo from Ures, east of the municipal capital, merging with the San Miguel de Horcasitas River; these running waters are stored behind the Abelardo L. Rodríguez dam. Because of the region's generally dry conditions, the Sonora River vanishes in the plains before flowing into the Gulf of California, only reaching the ocean when there are extraordinary rains. The La Poza gives rise to the San Miguel de Horcasitas. The Bacoachi River originates in the northwest, and usually also vanishes before reaching the sea (INEGI, 1998).

According to INEGI (1973) climate categories are Bw(h')hw(x') (very dry-hot subtype) and BSo(h')hw(x') (dry with low rainfall throughout the year). The annual average rainfall is between 230 and 400 mm, were 50–70% of the rains occurring during the summer season (June–September).

The average maximum temperature is 36–39°C during May–October, and the average minimum is 18°C. Between November and April, the average maximum temperature is 24°C, and the average minimum is 6°C. Frost can occur in the months of December and January, with fewer than 8 days expected.

Soils types present in the area, according to INEGI (1979) are eutric and calcareous regosol, orthic solonchak, chromic vertisol, phaeozem and luvic yermosol and luvic xerosol, and to a lesser extent lithosol. Generally these are deep soils, medium to fine textured, and their consistency is from gravelly to stony.

Brown (1982) described the vegetation as follows:

Hermosillo vegetation	Sonoran desert scrub	Central Gulf Coast subdivision	<i>Bursera-Pachycereus</i> series
			<i>Fouquieria-Jatropha-Larrea</i> series
		Plains of Sonora subdivision	
	Sinaloan thorn scrub		

Sonoran desert scrub

The Sonoran Desert has been divided into six regions, based on floristic and environmental characteristics (Brown, 1982; Schmidt, 1989); these are the Lower Colorado River Valley, Arizona Upland, Vizcaíno, Magdalena Region, Central Gulf Coast and Plains of Sonora. These last two are represented in the municipality of Hermosillo.

Central Gulf Coast subdivision

The main floristic elements of this subdivision are widely spaced shrubs of *Jatropha* (Sangre de Drago), *Euphorbia* (Spurge) *Fouquieria* (Ocotillo) *Larrea tridentata* (Creosote Bush) and small trees such as *Cercidium* (Palo Verde), *Olneya tesota* (Palo Fierro) and *Bursera* (Elephant Tree). These trees are remarkably abundant in open areas.

- *Bursera-Pachycereus* series: This community, of granitic origin with trees up to 3-4 m high, is dominated by *Bursera hindsiana*, *B. microphylla* (Elephant Tree), *Cercidium microphyllum* (Foothills Palo Verde), large shrubs *Fouquieria splendens* (Ocotillo), and columnar cacti *Pachycereus pringlei* (Cardón). Shrubs less than 2 m high include *Solanum hindsianum* (Sonoran Nightshade), *Ambrosia dumosa* (Burro Weed), *Encelia farinosa* (Brittlebush), *Jatropha cinerea* (Arizona Nettle-spurge) and *J. cuneata* (Limberbush). The cactus *Cylindropuntia bigelovii* (Teddy Bear Cholla) is significant in this type of vegetation.
- *Fouquieria-Jatropha-Larrea* series: This series is located on slopes at the base of coastal mountains. It is composed of *Fouquieria splendens* (Ocotillo), *Jatropha cuneata* (Limberbush) and *Larrea tridentata* (Creosote Bush), complemented by *Encelia farinosa* (Brittlebush) as subdominant, and to a lesser extent *Ferocactus acanthodes* (California Barrel Cactus). Other subdominants include *Ambrosia deltoidea* (Triangle-leaf Bursage), *Cylindropuntia bigelovii* (Teddy Bear Cholla), *Pachycereus pringlei* (Cardón) and

Lophocereus schottii (Senita).

Plains of Sonora subdivision

The beginning of this zone is marked by the appearance of trees, reduced coverage from *Larrea tridentata*, an increase in forbs and a decrease in cacti. Dominant trees, both in size and number are *Olneya tesota* (Palo Fierro), *Prosopis velutina* (Velvet Mesquite) and *Cercidium microphyllum* (Foothills Palo Verde). Other important trees are *Cercidium praecox* (Chañar Brea), *Cercidium floridum* (Blue Palo Verde), *Parkinsonia aculeata* (Retama), *Atamisquea emarginata* (Vomitbush) and *Forchammeria watsonii* (Palo San Juan). Other species that may also be present are Sinaloan thornscrub species such as *Jatropha cordata* (Papelillo), *Bursera laxiflora* (Torote Prieto), *Fouquieria macdougalii* (Mexican Ocotillo), *Guaiaacum coulteri* (Guayacán), *Cercidium sonora* (Sonoran Palo Verde), *Ipomea arborescens* (Tree Morning Glory) and *Ceiba acuminata* (Silk Cotton Tree).

Other species that are occasionally present are: *Acacia constricta* (Whitethorn Acacia), *Caesalpinia pumila* (Palo Piojo), *Calliandra eriophylla* (Pink Fairy Duster), *Celtis pallida* (Desert Hackberry), *Cordia parvifolia* (Littleleaf Cordia), *Croton sonora* (Sonora Croton), *Coursetia glandulosa* (Rosary Baby Bonnets), *Eysenhardtia orthocarpa* (Kidneywood), *Jacobinia ovata* (Jacobinia) *Lantana horrida* (Texas Lantana), *Lycium brevipes* (Wolfberry) *Sapium biloculare* (Mexican Jumping Bean), *Tecoma stans* (Yellow Elder) and *Zyziphus obtusifolia* (Gumdrop Tree). Even though cactus are common, they are not dominant. The following species occur: *Rathbunia alamosensis* (Octopus Cactus), *Stenocereus thurberi* (Organ Pipe Cactus), *Lophocereus schottii* (Senita), *Cylindropuntia arbuscula* (Branched Pencil Cholla), *C. fulgida* var. *mamillata* (Boxing Glove Cholla), *C. leptocaulis* (Pencil Cholla) and *C. thurberi* (Thurber's Cholla).

Sinaloan thorn scrub

This vegetation type is scattered within the municipality. This vegetation structure is mainly composed of deciduous trees in the dry season, spiny, pinnate leaves, multi-trunk trees and / or shrubs between 2 and 7.5 meters in height. This type of vegetation can hold between 1200 and 2000 perennial plants per hectare (Gentry, 1942, cited by Brown, 1982). The most common plant species in this vegetation type are: *Acacia angustis-*



Figure 2. Typical Sonoran desert scrub in the area, away from metropolitan Hermosillo. Photograph by Ian Recchio.

sima (White Ball Acacia), *A. constricta* (White Thorn Acacia), *A. cochliacantha* (Chirahui), *A. farnesiana* (Sweet Acacia), *A. pennatula* (Tepame), *Aloysia palmeri* (Palmer Beebrush), *Ambrosia cordifolia* (Sonoran Bursage), *Bursera odorata* (Copal Blanco), *Caesalpinia pumila* (Palo Piojo), *Ceiba acuminata* (Silk Cotton Tree), *Celtis pallida* (Desert Hackberry), *Cercidium sonorae* (Sonoran Palo Verde), *Dodonaea viscosa* (Giant Bush Hop), *Encelia farinosa* (Brittlebush), *Eysenhardtia orthocarpa* (Kidney Wood), *Fouquieria macdougalii* (Mexican Ocotillo), *Guaiacum coulteri* (Guayacán), *Haematoxylon brasiletto* (Palo Brasil), *Ipomea arborescens* (Tree Morning Glory), *Jacquinia pungens* (Cudjoe Wood), *Jatropha cardiophylla* (Limberbush), *Karwinskia humboldtiana* (Coyotillo), *Lantana velutina* (Velvet Shrub Verbena), *Lysiloma divaricatum* (Mauto), *Mimosa laxiflora* (Arizona Mimosa), *Olneya tesota* (Palo Fierro), *Piscidia mollis* (Fish Poison Tree), *Randia obcordata* (Crucillo) and *Sapium biloculare* (Mexican Jumping Bean). Some desert cacti are also present, such as: *Stenocereus thurberi* (Organ Pipe Cactus), *Pachycereus pecten-aboriginum* (Indian Comb), *Rathbunia alamosensis* (Octopus Cactus), *Cylindropuntia fulgida* (Boxing Glove Cholla), *Cylindropuntia thurberi* (Thurber Cholla), and *Lophocereus schottii* (Senita).

Material and Methods

We examined 91 amphibian and 251 reptile specimens collected in the continental portion of the municipality of Hermosillo, Sonora, including those deposited in the herpetological collection from the Centro Ecológico de Sonora (CES) and collected during fieldwork conducted between 1987 and 1990. Specimens were preserved according to the techniques described by Pisani and Villa (1974), and are now deposited in the herpetological collection of the Laboratorio de Herpetología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo Leon (UANL).

Snake hooks and adapted fishing rods were used to capture lizards, and fishnets were used for capturing aquatic turtles (accidental). Collecting surveys were done both day and night, with two different collecting methods: the first method consisted of traveling cross-country, advancing on foot in a particular zone, using flashlights for nocturnal collecting. The second was accomplished by excursions in a vehicle with a speed of 20 to 40 km/h or less on paved or dirt roads, collecting live specimens crossing roads, or DORs (Casas-Andreu et al., 1991).

Specimens were identified using basic keys from Smith and Taylor (1966), and accounts from the *Catalogue of American Amphibians and Reptiles* published by the Society for the Study of Amphibians and Reptiles (SSAR), as well as references that were considered most appropriate for each case. In addition, nomenclatural adjustments were made.

In order to analyze the geographical affinity, we used the criteria and nomenclature defined by Enderson et al. (2009) that compared Sonora with the adjacent states. In this case, we compared the municipality of Hermosillo against the rest of the state. We only considered species level to facilitate analysis in the comparison. We did not consider marine species or island-endemic species.

Results are presented in a phylogenetic order, according to Flores-Villela (1993b) while the protection categories or status are those of SEMARNAT (2010).

Results

Species studied during this investigation are listed under some degree of protection according to the Norma Oficial Mexicana (SEMARNAT, 2010). The protection of Mexico's native flora and fauna is categorized as follows: 3 anurans are categorized as subject to special protection; 12 species of reptiles are considered to be endangered and 14 species of reptiles are subject to special protection, as shown in the Table 1.

It is important to emphasize that some taxa have recently been elevated to species level, so their status is different from the SEMARNAT (2010) designation. Although the Norma Oficial Mexicana should have a strict legal validity, for the purpose of this paper we have considered these new species to fall under the same protection status as the taxa they formerly belonged to. For these species the protection status is followed by an asterisk (*).

As for the biogeographic affinity of Hermosillo's herpetofauna, we found that of the total 61 registered species, 24 are properly Sonoran, 13 are generalists, 11 tropical, 10 are generalists for American Deserts, two Great Plains and one is introduced or invasive. The comparison between the municipality of Hermosillo with respect to the state of Sonora is detailed in Figure 3.

Discussion and conclusions

Before this study, the only herpetological inventory of the area consisted of a few isolated reports. The present paper reports 61 herpetofaunistic species in the municipality of Hermosillo, distributed as follows: six families of amphibians, with seven genera and 11 species and 18 families of reptiles that comprise 41 genera and 50 species. Two species are represented by more than one subspecies in the municipality. These are *Uta stansburiana* (Side-blotched Lizard) and *Rena humilis* (Desert Threadsnake). Scientific names have been updated.

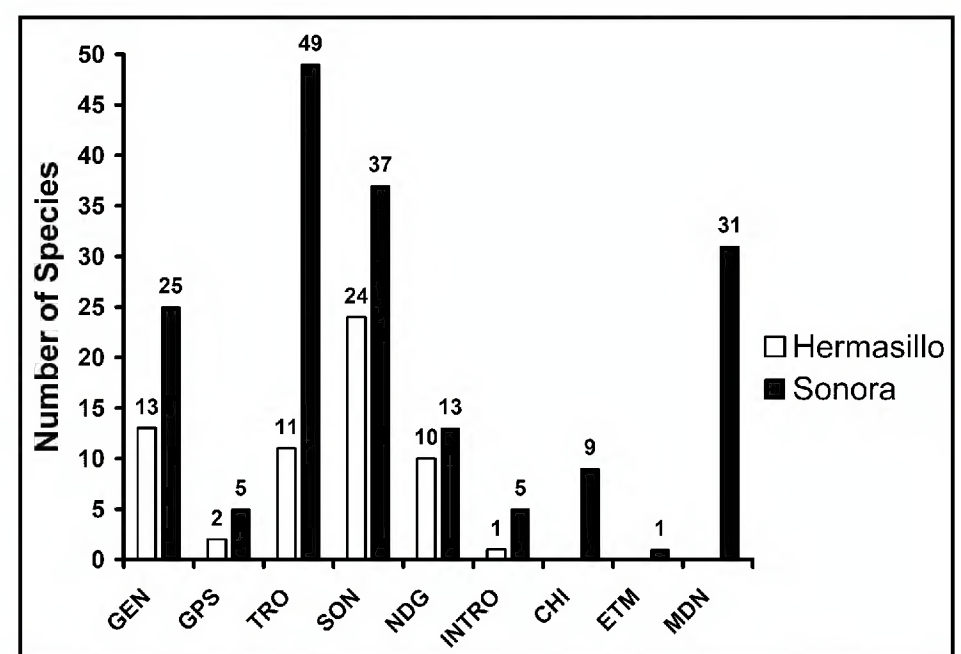


Figure 3. Comparison between the municipality of Hermosillo and the state of Sonora. CHI = Chihuahuan, ETM = Eastern Temperate, GEN = Generalist GBN = Great Basin, GPS = Great Plains, MDN = Madrean, NDG= North American Desert Generalist, SON = Sonoran, TRO = Tropical, INTRO = Introduced or Invasive.

Table 1. Taxa of amphibians and reptiles present in the municipality of Hermosillo. Status = protection status in the Mexican NOM-059-SEMARNAT-2010: A = *Amenazada* (Threatened); Pr = *Protección Especial* (Special Protection). * indicates that the status shown here has been carried over from an earlier taxonomic designation.

Taxon	Common name	Status
Amphibia: Anura		
Family Scaphiopodidae		
<i>Scaphiopus couchii</i> Baird, 1854	Couch's Spadefoot	
Family Bufonidae		
<i>Anaxyrus cognatus</i> (Say, <i>In</i> James, 1822)	Great Plains Toad	Pr
<i>Anaxyrus kelloggi</i> (Taylor, 1938 "1936")	Little Mexican Toad	
<i>Anaxyrus punctatus</i> (Baird and Girard, 1852)	Red-spotted Toad	
<i>Anaxyrus retiformis</i> (Sanders and Smith, 1951)	Sonoran Green Toad	
<i>Incilius alvarius</i> (Girard, <i>In</i> Baird, 1859)	Colorado River Toad	
<i>Incilius mazatlanensis</i> (Taylor, 1940 "1939")	Sinaloan Toad	
Family Leptodactylidae		
<i>Leptodactylus melanonotus</i> (Hallowell, 1861)	Sabinal Frog	
Family Hylidae		
<i>Smilisca fodiens</i> (Boulenger, 1882)	Lowland Burrowing Tree Frog	
Family Microhylidae		
<i>Gastrophryne olivacea</i> (Hallowell, 1856)	Great Plains Narrow-mouth Toad	Pr
Family Ranidae		
<i>Lithobates forreri</i> (Boulenger, 1883)	Forrer's Grass Frog	Pr
Reptilia: Testudines		
Family Emydidae		
<i>Trachemys nebulosa hiltoni</i> (Carr, 1942)	Río Fuerte Slider	Pr*
Family Kinosternidae		
<i>Kinosternon alamosae</i> Berry and Legler, 1980	Alamos Mud Turtle	Pr
<i>Kinosternon arizonense</i> Gilmore, 1922	Arizona Mud Turtle	
<i>Kinosternon sonoriense sonoriense</i> LeConte, 1854	Sonoran Mud Turtle	
Family Testudinidae		
<i>Gopherus morafkai</i> Murphy, Berry, Edwards, Leviton, Lathrop and Riedle, 2011	Morafka's Desert Tortoise	A*
Reptilia: Squamata—Lizards		
Family Gekkonidae		
<i>Phyllodactylus homolepidurus homolepidurus</i> Smith, 1935	Sonoran Leaf-toed Gecko	Pr
Family Eublepharidae		
<i>Coleonyx variegatus sonoriensis</i> Klauber, 1945	Sonoran Banded Gecko	Pr
Family Iguanidae		
<i>Ctenosaura macrolopha</i> Smith, 1972	Sonoran Spiny-tail Iguana	Pr*
<i>Dipsosaurus dorsalis sonoriensis</i> Allen, 1933	Sonoran Desert Iguana	Pr
<i>Sauromalus ater townsendi</i> Dickerson, 1919	Northern Chuckwalla	
Family Crotaphytidae		
<i>Crotaphytus nebrius</i> Axtell and Montanucci, 1977	Sonoran Collared Lizard	Pr
<i>Gambelia wislizenii</i> (Baird and Girard, 1852)	Long-nosed Leopard Lizard	
Family Phrynosomatidae		
<i>Callisaurus draconoides inusitanus</i> Dickerson, 1919	Sonoran Zebra-tailed Lizard	A
<i>Holbrookia elegans thermophila</i> Barbour, 1921	Sonoran Earless Lizard	
<i>Phrynosoma solare</i> Gray, 1845	Regal Horned Lizard	
<i>Sceloporus clarkii clarkii</i> Baird and Girard, 1852	Sonoran Spiny Lizard	
<i>Sceloporus magister magister</i> Hallowell, 1854	Desert Spiny Lizard	

Table 1 (cont'd).

Taxon	Common name	Status
<i>Urosaurus ornatus schottii</i> (Baird, 1858)	Schott's Tree Lizard	
<i>Uta stansburiana stejnegeri</i> Schmidt, 1921	Desert Side-blotched Lizard	A
<i>Uta stansburiana taylori</i> Smith, 1935	Taylor's Side-blotched Lizard	A
Family Helodermatidae		
<i>Heloderma suspectum suspectum</i> Cope, 1869	Reticulate Gila Monster	A
Family Scincidae		
<i>Plestiodon obsoletus</i> Baird and Girard, 1852	Great Plains Skink	
Family Xantusiidae		
<i>Xantusia jaycolei</i> Bezy, Bezy and Bolles, 2008	Cole's Night Lizard	
Family Teiidae		
<i>Aspidoscelis burti</i> (Taylor, 1938)	Canyon Spotted Whiptail	
<i>Aspidoscelis tigris aethiops</i> (Cope, 1900)	Sonoran Tiger Whiptail	
Reptilia: Squamata—Snakes		
Family Typhlopidae		
<i>Ramphotyphlops braminus</i> (Daudin, 1803)	Brahminy Blindsnake	
Family Leptotyphlopidae	Desert Threadsnake	
<i>Rena humilis cahuilae</i> Klauber, 1939	Desert Threadsnake	
<i>Rena humilis dugesi</i> (Bocourt, 1881)	Mexican Threadsnake	
Family Boidae		
<i>Boa constrictor imperator</i> Daudin, 1803	Central American Boa Constrictor	A
<i>Lichanura trivirgata trivirgata</i> Cope, 1861	Mexican Rosy Boa	A
Family Colubridae		
<i>Arizona elegans noctivaga</i> Klauber, 1946	Arizona Glossy Snake	
<i>Chilomeniscus stramineus</i> Cope, 1860	Variable Sandsnake	Pr
<i>Chionactis palarostris palarostris</i> (Klauber, 1937)	Sonoran Shovel-nosed Snake	
<i>Gyalopion quadrangulare</i> (Günther, 1893)	Thornscrub Hook-nosed Snake	Pr
<i>Hypsiglena chlorophaea chlorophaea</i> Cope, 1860	Sonoran Nightsnake	
<i>Lampropeltis getula nigrata</i> Zweifel and Norris, 1955	Western Black Kingsnake	A
<i>Coluber bilineatus</i> (Jan, 1863)	Sonoran Whipsnake	
<i>Coluber flagellum cingulum</i> (Lowe and Woodin, 1954)	Sonoran Coachwhip	A
<i>Oxybelis aeneus</i> (Wagler, 1824)	Brown Vinesnake	
<i>Phyllorhynchus browni</i> Stejneger, 1890	Saddled Leaf-nosed Snake	Pr
<i>Phyllorhynchus decurtatus</i> (Cope, 1868)	Spotted Leaf-nosed Snake	
<i>Pituophis catenifer affinis</i> (Hallowell, 1852)	Sonoran Gopher Snake	
<i>Rhinocheilus lecontei lecontei</i> Baird and Girard, 1853	Western Long-nosed Snake	
<i>Salvadora deserticola</i> Schmidt, 1940	Big Bend Patchnose Snake	
<i>Tantilla hobartsmithi</i> Taylor, 1936	Smith's Black-headed Snake	
<i>Thamnophis cyrtopsis cyrtopsis</i> (Kennicott, 1860)	Western Black-necked Gartersnake	A
<i>Trimorphodon biscutatus lambda</i> Cope, 1886	Sonoran Lyresnake	
Family Elapidae		
<i>Micruroides euryxanthus euryxanthus</i> (Kennicott, 1860)	Arizona Coralsnake	A
<i>Micruroides euryxanthus australis</i> Zweifel and Norris, 1955	Sonoran Coralsnake	A
Family Crotalidae		
<i>Crotalus atrox</i> Baird and Girard, 1853	Western Diamond-backed Rattlesnake	Pr
<i>Crotalus cerastes cercobombus</i> Savage and Cliff, 1953	Sonoran Sidewinder	Pr
<i>Crotalus molossus molossus</i> Baird and Girard, 1853	Northern Black-tailed Rattlesnake	Pr
<i>Crotalus tigris</i> Kennicott, <i>In</i> Baird, 1859	Tiger Rattlesnake	Pr



Figure 4. The beautiful head scales of *Sceloporus clarkii clarkii*. Photograph by Ian Recchio.

In this study, we also found a 66-mm-long specimen of *Smilisca fodiens*. This measurement is longer than the 63 mm previously reported for this species (Trueb, 1969), and therefore represents a new record for this characteristic.

In northern Sonora and southern Arizona, there is the report of four subspecies of *Rena humilis* in an intergradation zone (Hahn, 1979a,b). If the number of dorsal scales on vertebral line is taken as the main criterion, the specimens of this species collected in the municipality of Hermosillo are tentatively assigned to two subspecies: *Rena humilis dugesi* from the urban area, and *Rena humilis cahuilae* from the coastal region (Highway 35). However, if the number of caudal scales is taken into account, one of the specimens of the conurbation area of Hermosillo and the specimen of the coast differ from each other presenting 15 caudal scales, while the characteristic for *Rena h. dugesi* has more than 15 caudal scales, with an average of 17 and *R. h. cahuilae* is from 16 to 21 caudal scales. Another diagnostic feature is the number of rows of pigmented dorsal scales, which could not be confirmed due to the discoloration of the specimens. The great variation in the number of dorsal scales on vertebral line (251, 252 and 289) seems to indicate the presence of an intergradation zone between *R. h. cahuilae* and *R. h. dugesi*, while the low number of caudal scales may indicate the genetic influence of *R. h. humilis*, which can present from 15 to 21, which would extend the area of intergradation in at least three forms from the north to the center of the state. A more intense study and collecting is necessary to answer all of these questions.



Figure 6. *Boa constrictor imperator* from the Hermosillo area. Photograph by Ian Recchio.

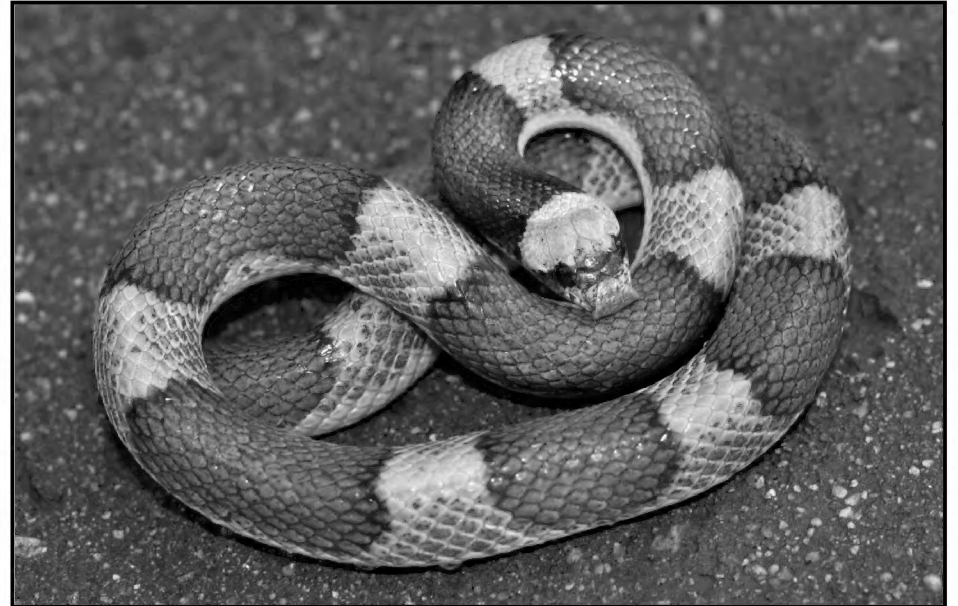


Figure 5. *Phyllorhynchus browni*, a specialist feeder, forages for the eggs of lizards and snakes. Photograph by Ian Recchio.

It has been documented that the number of caudal scales in females of *Coluber bilineatus* varies between 121 and 167 (Camper, 1996); one of the females examined here had an incomplete tail, while another had 117 caudal scales, which ranks it below what has been reported for the species.

Wilson (1970, 1973) reports 97–121 caudal scales for male *Coluber flagellum cingulum*, and 91–111 for females. Specimens from Hermosillo differ from the reports, 85–119 caudal scales in males and 70–107 for females. These specimens were assigned to this subspecies because of their matching colors, which is considered a diagnostic feature.

Analysis of *Micruroides euryxanthus* specimens from Hermosillo suggests the existence of a integration zone between *Micruroides euryxanthus australis* and *Micruroides euryxanthus euryxanthus*, which had not been documented in the northern part of the state (Roze, 1974). In addition, one of the examined specimen's presented a number of red scales in the vertebral line that would place it outside the normal range. Therefore, more specimens from the area are required to determine whether this difference is due to an anomaly, a range expansion of this variation, or simply a different, undescribed species.

A specimen of *Crotalus molossus molossus* analyzed had 182 ventral scales. Klauber (1972) mentions the number of ventral scales for this species ranges from 185 to 199. This observation widens the degree of variation known for this characteristic.



Figure 7. An excellent representative species of the municipality of Hermosillo and state of Sonora, Gila monsters, *Heloderma suspectum suspectum*, are even found near the ocean. Photograph by Ian Recchio.



Figure 8. *Crotalus tigris*, one of the most beautiful rattlesnakes of Mexico. Photograph by Ian Recchio.

Species not found during the field work correspond generally to those with secretive and restricted habits, or those only active for a short season.

Many species in the study area are listed under some degree of protection according to SEMARNAT (2010). Of these, three anurans are categorized as subject to special protection, 12 spe-

cies of reptiles are considered to be endangered, and 14 species are subject to special protection. Based on our field observations, we recommended the establishment of additional protective measures for *Gopherus agassizii* (now *Gopherus morafkai*) in order to avoid their disappearance from the region due to the pressure exerted by illegal collecting, vehicles, and the threats created by urban development and other changes in land use.

The biogeographic affinity of the species present in the municipality is mainly Sonoran, as well as generalist, tropical and generalist to American deserts, with the scarce presence of two Great Plains species. Those of Madrean and Chihuahuan affinity are absent. These results are consistent with the geographic position of the municipality, which is immersed in the Sonoran Desert, but has great tropical influence, and is located far from the Sierra Madre Occidental and the Chihuahuan Desert.

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The Filter Feeding Mechanism in Tadpoles

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Abstract

The tadpoles of *Duttaphrynus stomaticus*, *Microhyla ornata*, *Euphlyctis cyanophlyctis*, *Fejervarya limnocharis*, *Zakerana syhadrensis* and *Holobatrachus tigerinus* develop sympatrically in the ponds and puddles of the Punjab riparian system in the Indus Valley, all deriving nourishment from pond resources. The present paper discusses the buccopharyngeal particulate food processing in the tadpoles of these six species. *Microhyla ornata* is a microphagous plankton feeder; *Duttaphrynus stomaticus* is a macrophagous vegetation rasper; both *Fejervarya limnocharis* and *Zakerana syhadrensis* are macrophagous raspsers as well as microphagous plankton feeders. However, *Euphlyctis cyanophlyctis* is detritivorous and *Holobatrachus tigerinus* is a larvivore–carnivore. Despite these differences in diet, all six of these species employ similar buccopharyngeal mechanisms to retrieve particulate food suspended in the water current passing through the buccopharyngeal cavity.

Introduction

The larval phase of a frog's life is crucial; during it selection forces are strong and most effective. The tadpole is ever at the mercy of fluctuations in its aquatic environment: rise and fall in water level, temperature, salt concentration, scarcity / abundance of food, etc. The tadpole with its simple morphology wondrously copes with all while remaining within the confines of the pond. Moreover, the tadpole has the hard task of protecting itself from a multitude of predators: different species of fishes; aquatic carnivorous insects and their larvae; sympatric cannibalistic inter- and intraspecific tadpoles.

However, despite fragility in structure, tadpoles manage all these hazards because of their highly plastic adaptability, employing strategies such as retreating and camouflage (Heyer et al., 1975; Dodd and Cupp, 1978; Wassersug, 1980, 1989; Wassersug and Heyer, 1988).

The tadpoles of *Duttaphrynus stomaticus*, *Microhyla ornata*, *Euphlyctis cyanophlyctis*, *Fejervarya limnocharis*, *Zakerana syhadrensis* and *Holobatrachus tigerinus*, develop sympatrically in the ponds and puddles of the Punjab riparian system in the Indus Valley, all deriving nourishment from pond resources (Khan, 1991).

Materials and Methods

The tadpoles for the present study were collected using finely meshed hand nets from ponds and puddles (Khan and Malik, 1987). *Microhyla* tadpoles were netted at midstream, while *Duttaphrynus* were scooped from marginal water; however ranids were difficult to collect, since they are quick to retreat to the bottom of the pond. They were dredged out together with much mud. The net was kept in the water and the swimming tadpoles were scooped out with a teapot sieve.

The collected tadpoles were kept for about half an hour in clear water to wash away any pond debris from the body and buccopharyngeal region.

Fixation: Tadpoles at Stage 35 were processed by fixing in Bouin's fixative (following Khan, 1965), and stored in Bouin's diluted 1:1 with water, as suggested by Khan (1982). The shape and pigment of the tadpole are ideally preserved, though the belly iridocytes of *Microhyla* are lost. The yellow color of picric acid in the fixative accentuates morphological features on the oropharyngeal surfaces.

To study cartilaginous support of the ventral velum, the tadpoles were stained by alcian blue (Hanken and Wassersug, 1981). Cartilage was stained deep blue, while the rest of the tissue was light blue.

Surgical Procedure: The tadpole was fixed belly up in a groove excavated out of wax in the center of the dissection dish. The tip of a fine scissors was gently inserted in one side of its mouth. The buccal wall was cut back along the lateral side up to the end of the branchial cavity. Another similar cut was made on the other side. A third transverse cut was made across the posterior pharyngeal region, freeing the buccopharyngeal floor from its roof (Khan, 1991).

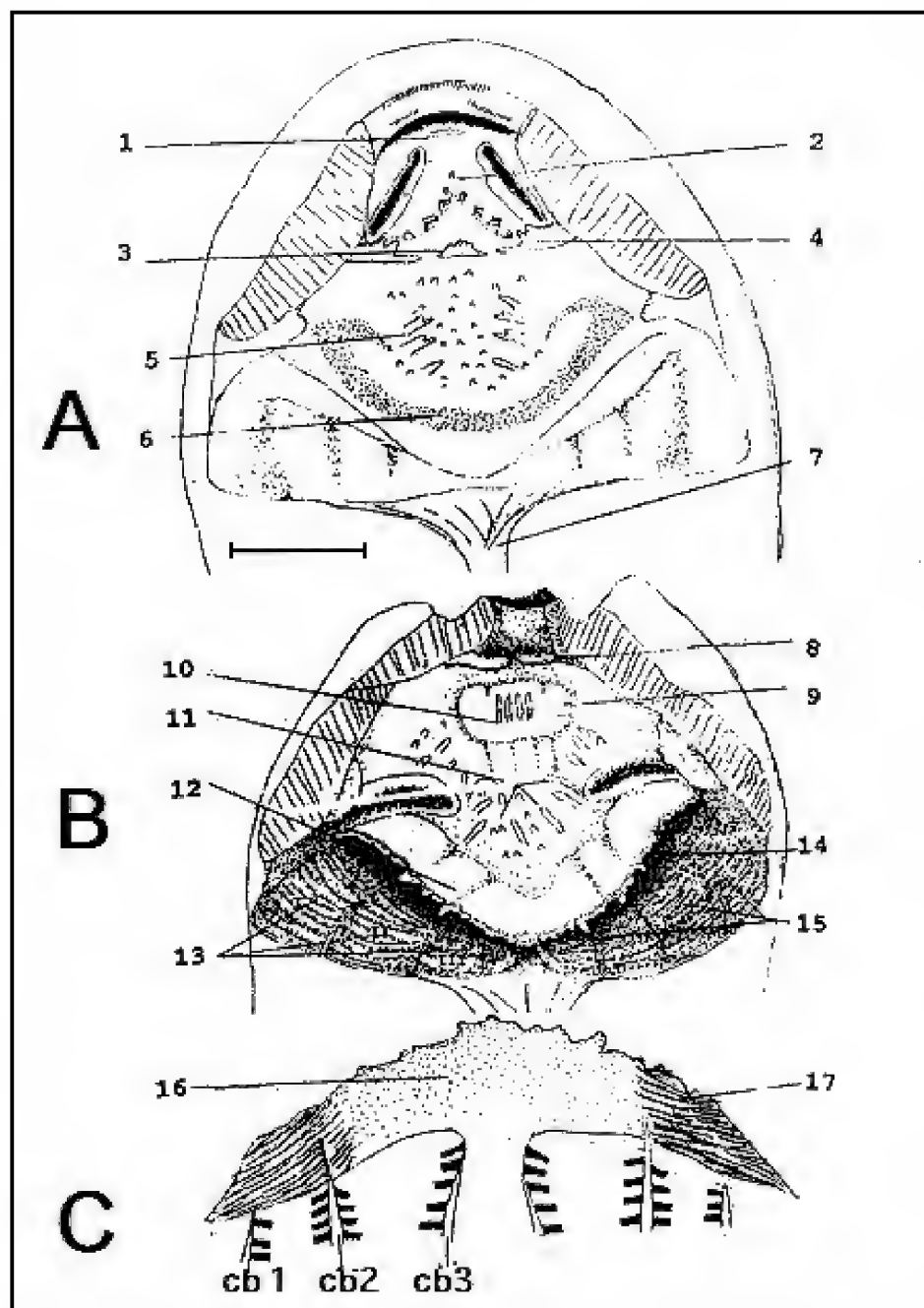
For identification of structures on exposed surfaces text Figures A, B and C are provided, with indicators referred to in the text.

Observations and Comments

Food acquisition

Orton (1953) classified amphibian tadpoles on the basis of modes of feeding. The *Microhyla ornata* tadpole is placed in type II (without oral disc); while the tadpoles of the other five species considered here are classified as type IV (with well developed oral disc).

Type II tadpoles stay in the plankton-rich layers at the middle of the pond, constantly gulping water laden with food particles into the buccal cavity. Type IV tadpoles use keratinized denticles and sharp, serrated, strong beaks to scrape cells from submerged vegetative surfaces, with the scraped material joining the water current entering the buccal cavity. In both cases the parti-



Stage 35 *Duttaphrynus stomaticus* tadpole (Khan, 1965), dissected to show buccopharyngeal structures referred to in the text (Scale: 1 mm).

A. Buccopharyngeal roof: 1 = Prenarial ridge; 2 = Narial pustular ridge; 3 = Median ridge; 4 = Lateral ridge papilla; 5 = Buccal roof papillae and pustules; 6 = Glandular pitted band; 7 = Esophagus.

B. Buccopharyngeal floor: 8 = Infralabial papillae; 9 = Larval tongue; 10 = Tongue papillae; 11 = Buccal floor papillae; 12 = Ventral velum; 13 = Filter cavities; 14 = Food traps; 15 = Filter plates.

C. Ventral velum, showing subvelar glandular surface: 16 = Pitted; 17 = Ridged; Cb1–Cb3 = Ceratobranchials.

cles are entrapped in sticky mucus secreted by special glands situated along roof and floor of the pharyngeal walls (Khan, 1991; Khan and Mufti, 1994a, b).

The “sucking-in” process involves a complex mechanism: the buccopharyngeal walls expand to suck water in and contract to pump it forward in the pharyngeal passage, pushing the Meckel’s cartilage forward and backward so that the suspensorium allows forward expansion of the ceratohyals. The articulation of ceratohyal with palatoquadrate moves up and down. The floor of the buccal cavity thus acts as the piston of the buccal pump. One-way flow is ensured by valves in the buccal cavity. The food particles are trapped in mucus and water passes out through the spiracle (Seale and Wassersug, 1979; Khan, 1991).

Particle processing mechanism

Oral processing: In Type IV tadpoles, the rasped and cut food particles are carried in the water current entering the buccal cavity. In the *Microhyla* tadpole particulate food passes through the U-shaped mouth into the buccal cavity. A series of infra-

labial papillae (Figure B. 8) forms a sieve which keeps large particles from entering the oral cavity.

Buccal Processing: Strategically placed buccopharyngeal elements are on the roof and floor of the buccal cavity and on the branchial surfaces help in food processing at this stage (Figures A, B, C). Morphology and arrangement of these elements differ among species of tadpoles, depending on the food particle size and its concentration (Khan, 1991). These buccopharyngeal organs are:

- **Ridges:** Special elevated structures along the roof of the buccal cavity: prenarial ridge (Figure A. 1) and median ridges (Figures A. 2, 3) regulate the speed of water current in the buccal cavity. The prenarial ridge helps in cutting coarse food particles.
- **Cilia:** Microscopic cilia are scattered on the lining of the buccal cavity. They help direct the particulate food to the median ciliary groove leading into esophagus.
- **Papillary organs:** In Type IV tadpoles, the buccal lining is lined with pustules and papillae (Figures A. 5, B. 11) which are simple, thin, straight or curved, delicate structures, gradually attenuated to pointed simple or bifurcated tips. The papillae are arranged in groups. The infralabial (Figure B. 8) and lateral ridge papillae (Figure A. 4) are large and palmate.

Pustules and papillae are sensitive to the size of the food particle and its concentration in the current, according to which the tadpole adjusts food processing in buccal and branchial cavities. The tongue papillae (Fig. B. 9, 10) are sensitive to chemicals in the current.

In microhylids, the papillae coalesce at the base to form delicate oblique ridges which guide the water current to the glandular strips in the pharynx.

- **Buccal glands:** A broad glandular band (Figure A. 6) extends from sides to all along the outermost border of the roof of the buccal cavity. It is relatively broad in microhylid tadpole. It is covered with fine openings of the mucous glands, secreting fine sheets of mucus, trapping the particulate food.

- **Subvelar glands:** The buccal floor extends backward over the branchial basket as the ventral velum (Figure B. 12). The branchial plates (Figure C. cb) are attached under it. Parts of the branchial cavities (Figure B. 13) under the ventral velum form food traps (Figure B. 14). The subvelar surface (Figure C) and attachment of branchial plates differ in different species of tadpoles, depending on the size and type of the food particle they process (Khan, 1991). In coarse particle feeders it is pitted (Figure C. 16), while in fine particle feeders it is ridged (Figure C. 17). In species feeding on heteromorph particles both pitted and ridged patterns are found (Khan, 1991; Khan and Mufti, 1994a, b).

Food particle retrieval

The particulate retrieval process takes place in two stages. It starts in the buccal cavity and is completed in the pharyngeal cavities:

Buccal processing: Strands of mucus secreted from the general buccal lining and the buccal glandular strip are carried in the water current; food particles get stuck in them. The food-laden mucus is swept down into the branchial basket, where finer particles which might have escaped from buccal entrapment, are entrapped by more sticky mucus secreted from the subvelar glands in the food traps.

Pharyngeal processing: The pharyngeal food traps or branchial baskets of the tadpole lie at the posterior sides of the buccal cavity (Khan, 1991). The branchial baskets are divided into branchial or filter cavities (Figure B. 13), the number of which differs among species. The branchial cavities are lined by close-set branchial plates, covered with fine, intricate folds which form the filter ruffle, through which the water current passes. The mesh size of the filter ruffle differs among species according to the fineness of the particulates utilized as food. The filter ruffle acts as an efficient sieve. After passing through the filter ruffle, the water current is free from particulate material. The food-laden mucus is retained in the branchial cavities and then carried through special ciliated grooves into the esophageal orifice (Figure A. 7), while water passes out of the branchial region through the spiracle (Gradwell, 1975; Wassersug, 1980; Wassersug and Rosenberg, 1979; Khan, 1991).

Conclusions

The six species of riparian tadpole utilize the common food

base available in the pond ecosystem in distinct ways, avoiding competition. Similar trophic partition has been reported in adults and larvae of south Indian amphibians (Das, 1992). Though the tadpoles are phytophagous, their diet includes a considerable amount of zooplankton, which they suck in with the water current. The microphagous *Microhyla ornata* takes zooplankton as it filter feeds on microscopic organic planktonic matter that grows in water column and remains suspended (Khan, 2001). Though *Duttaphrynus*, *Fejervarya* and *Zakerana* tadpoles are typical rasps on submerged plant surfaces, they ingest large quantities of zooplankton along with the water current that carries the particulate food (Khan and Mufti, 1994a, b; Khan, 1996). The large *Euphlyctis cyanophlyctis* tadpole feeds on detritus fauna and rotten vegetation, which thrives at the bottom of pond (Khan and Mufti, 1995). The larvivorous *Holobatrachus tigerinus* tadpole is not an exception. Though it feeds mainly on tadpoles of its own kind and other species (Khan, 1997), its feeding current may carry zooplankton also. Larger species like *Daphnia* and *Cyclops* are filtered by its poor filter ruffle, while smaller organisms pass out. Moreover, as pond water ages it becomes richer in zooplankton, enriching the diet of the *Microhyla* tadpole with protein. In later stages of development, after Stage 35, Type IV tadpoles seek to supplement their diet with more protein, which they get by occasionally devouring sympatric tadpoles, drowned frogs, earthworms etc., to quicken the metamorphic process, which is necessary in the unpredictable temperate riparian environs of Punjab.

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What You Missed at the July Meeting

John Archer
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I know you've had those moments when you're just not that interested; you're trying to stifle a yawn when something sinks through your ennui and your brain snaps into focus on a subject you would never have thought would hold your attention, let alone capture your interest and arouse your imagination. Truly sublime moments that provide one with the intense pleasure of serendipitously discovering new knowledge. My vast ignorance allows me to experience these special moments perhaps more often than other people, which may be one of the benefits of not being really smart. I can't think of any other benefits.

I write that after just returning from the Turtle Survival Alliance's annual conference in Orlando, Florida. I'm no expert in turtles, but at this conference I get to mingle with those who are and I always have at least a couple of those special moments. I sit through many presentations, a very few of which do drag, but most of which cover topics that bring inspiration to my rapidly deteriorating brain. It's exciting to hear about research using hydrophones to listen to turtle vocalizations (Yeah, they talk. A lot.) or how satellites track gravid diamondback terrapins to nesting sites. But perhaps the most important part of these events is the mingling. Professors and researchers, breeders and zoo curators, and folks like me who are simply interested amateurs interact and interface, swapping ideas, findings, the latest news, and sometimes just gossip, but creating a synergy that expands and enhances the knowledge of the conservation work and general research being done on chelonians all over the world. The attendees came from many countries. Much of the knowledge I gained from the conference could have been obtained elsewhere or will be published soon, but perhaps the real advantage of such events is not the knowledge gained through the many lectures and presentations, but what one learns when talking with the people. Techniques and tips offered by an expert over a cup of coffee. A brief comment about a different way to glue on a transponder that saves money, time, and weight. A phone number to call when in a different city that will get you a guided tour given to only a select few. A recommendation of a paper or book that gives you that information you've been seeking for months. These events are networking at its best.

So where am I leading with all this? The Midwest Herpetological Symposium is October 17–19 in Indianapolis. It's hosted by the Hoosier Herpetological Society and a link to the pertinent info can be found at hoosierherpsoc.org. Whatever your interest in reptiles and amphibians, I promise you will come away from



Robert Jadin. Photograph by Dick Buchholz.

this conference better informed and more integrated into the herp community, with contacts and friends that can easily last a lifetime. It's close, it's inexpensive, and it's worth your time and energy. Share a ride and room with somebody. Just go. You'll be glad you did.

Which finally brings us to July's meeting. In light of my previous rantings, let me remind you that attending the monthly meetings gives you many of the same benefits of attending conferences. My poor renditions of our speakers' presentations not only deprive you of the total gestalt of hearing and seeing and asking in person, but it deprives you of that synergy generated by multiple bodies congregating more or less towards

the same goals. This is why I don't think meetings will be replaced by forums, the internet, Twitter, or Facebook. There is no better interaction between individuals than face to face, and our meetings provide that every month, not only with other members, but also with speakers who have a wide range of expertise. Our July speaker is an excellent example. Dr. Robert Jadin has this as a bio on his web page (which is worth a google):

I am a herpetologist and systematist studying morphological and molecular phylogenetics of reptiles. I am a lecturer in the Department of Biology at Northeastern Illinois University. Additionally, I am an adjunct researcher in the Dr. Eric N. Smith's Research Group and at the Amphibian and Reptile Diversity Research Center at the University of Texas at Arlington. I have a love for tropical fieldwork and concentrate a lot of my research to Central and South American taxa.

His love of fieldwork has been highlighted during his wife Sarah Orlofske's presentation in February. With the photos and anecdotes from Sarah's talk and the occasional slide in Robert's, mostly showing him in spectacular scenery holding a snake stick or a snake, it's easy to see that he enjoys being in the field. But his fieldwork leads to more than just an occasional captive specimen. His July talk was titled "Untangling a Phylogenetic Knot of Venomous Snakes: Evolutionary Discoveries of Highland Pitvipers from Middle America." He began by claiming that he is a successful cryptozoologist. With a slide showing alleged photos of bigfoot and the Loch Ness monster, he claimed that a cryptozoologist is someone who hunts for new species. Of course the pursuers of the aforementioned have had little success, but Robert has found and named not only new species, but also a new genus.

He briefly reviewed why we need taxonomy and phylogenetics, throwing in slides of Linnaeus and Darwin. Taxonomy



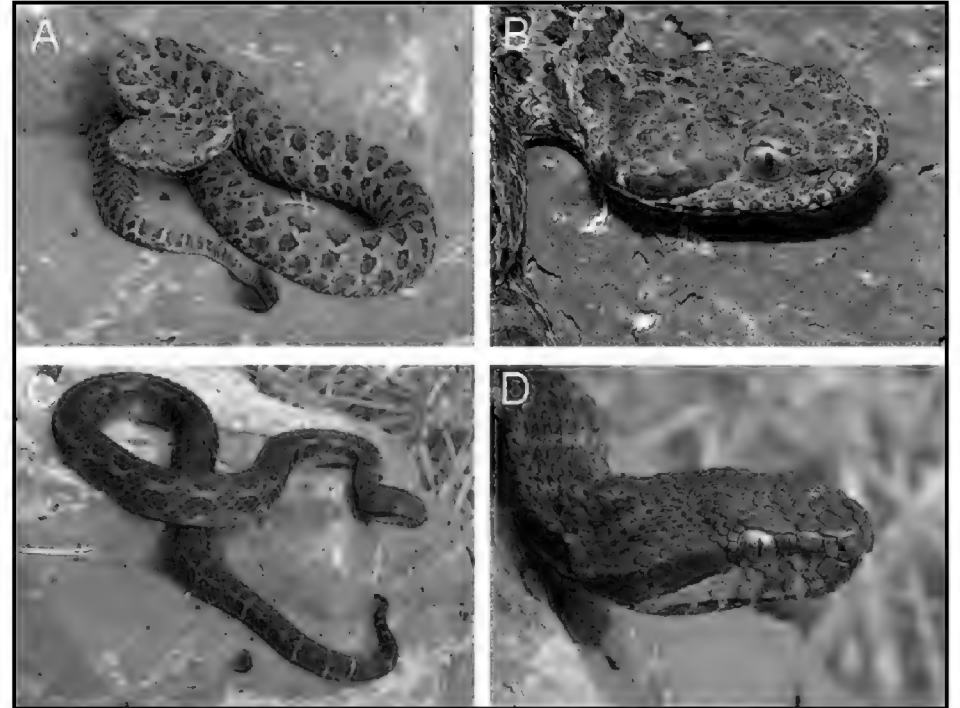
Bycatch from Robert's field trip to find live specimens of *Cerrophidion barbouri* and *Agkistrodon browni*. Everyone should have the thrill of stumbling upon a new species of rattlesnake, *Crotalus ericsmithi*. Photograph by Robert Jadin.

tells us what something is and phylogeny elucidates how it's related. Dr. Jadin's primary interest is pitvipers, particularly non-rattlesnake Central American vipers such as hog-nosed, montane, palm, horned, or jumping vipers. The latter genus (*Cerrophidion*) had some irregularities in the systematics. Using what he termed forensic science, Robert delved into the peculiar oddities of three species of jumping vipers and related to us the process involved in solving phylogenetic mysteries.

With photos of the different vipers, Robert described the situation when he first looked at *Cerrophidion*. The genus included four species but in a 1988 paper it was remarked that in *C. barbouri* "there is considerable variation in the size and arrangement of the dorsal cephalic scales . . . , perhaps more so than in any other species of snake." Variation in vipers is common, but with assistance from Jonathan Campbell who wrote the 1988 monograph, Robert pursued morphological differences that seemed to imply *C. barbouri* was actually two species. Using some of the most common scale counts to differentiate the two forms didn't yield significant results, but when scale counts were expanded to other areas of the body, and in particular the head, the two forms showed significant differences. But morphology of the two-dozen or so specimens available for



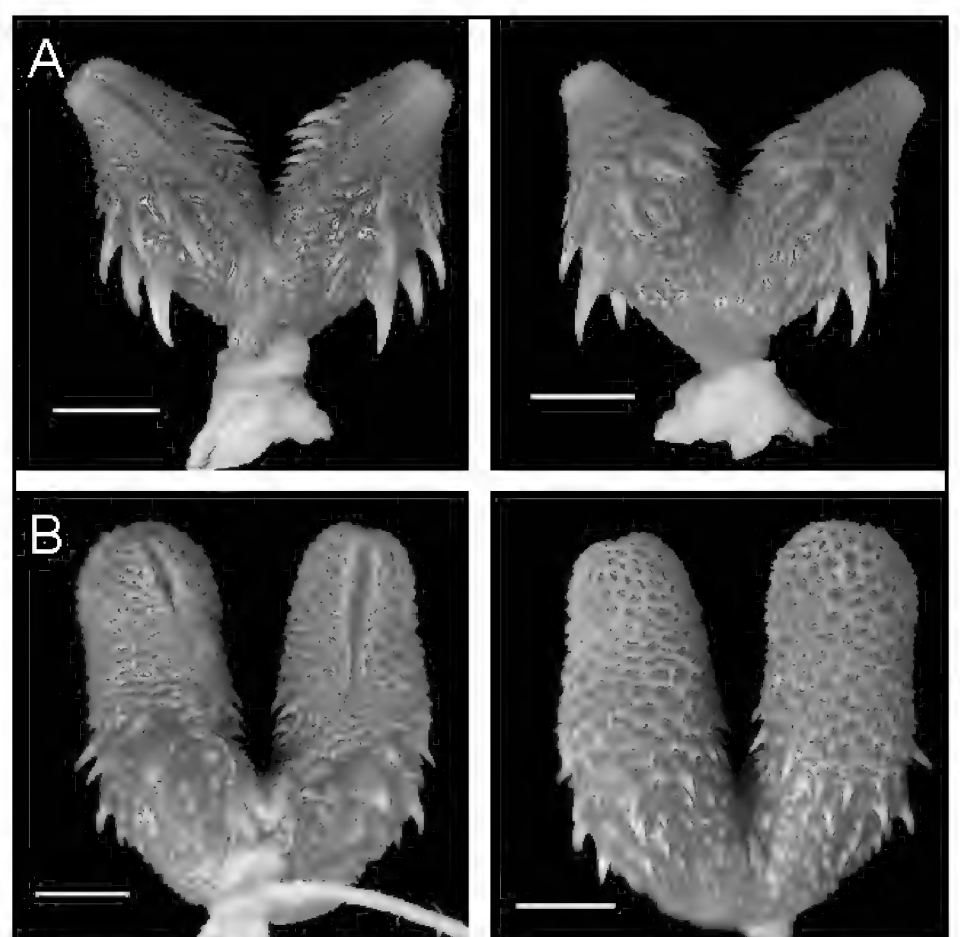
Mixcoatlus browni displaying a prehensile tail, an interesting clue to the species' placement among the pitvipers. Photograph by Robert Jadin.



These photos highlight the morphological differences between *Mixcoatlus browni* (above) and *M. barbouri*, particularly the differences in head scales. Photographs by Robert Jadin and Eric Smith.

study could not reveal the exact relationships of the two among the pitvipers. For that they would need live specimens and that meant fieldwork.

Photos of the group that went to Mexico allowed Robert to crack jokes about proper and improper field gear, or rather effective and ineffective gear. Wearing boots, long pants, and headlamps means not finding snakes. Dressing in shorts, flip flops, and a T-shirt leads one right to them. I think you can guess what Robert was wearing in the photos. The expedition just happened to discover a new species of rattlesnake and a new treefrog while looking for specimens of *C. barbouri*. We saw pictures of the rattlesnake, *Crotalus ericsmithi*, an absolutely gorgeous snake. Towards the major goal, the group managed to find specimens of both of the suspected species. For the first time, science had access to live specimens of the two forms. Now genetic analysis could be conducted.



Hemipenes are frequently used in snake phylogenetics. The hemipenes on top belong to *Mixcoatlus browni* and those on the bottom to *M. barbouri*. The difference is striking and one more piece of evidence that these are distinct species. Photographs by Robert Jadin.



The recently described *Bothriechis guifarroi*. A neat snake that took some sleuthing to place in the correct genus. Photographs by Josiah H. Townsend.

To complicate matters, one of the forms had been described in 1938 as *Agkistrodon browni* but in 1941 was synonymized with *C. barbouri*. Taxonomic rules say that the first species name given to a specimen will follow it into whatever genus it might be placed, so *browni* would remain the species, but what genus would these animals fall into? All of the *C. barbouri* had already been shown to be outliers in the *Cerrophidion* genus. Robert and his team determined that *A. browni* and *C. barbouri* were separate species and actually were more closely related to a Mexican horned viper, *Ophryacus melanurus*, than to any *Cerrophidion*. So closely related that Robert and team put all three of these highland vipers, *A. browni*, *C. barbouri* and *O. melanurus* into a new genus, *Mixcoathus*. The name is derived from an Aztec word meaning “cloud serpent.”

Robert split a species into two, moved those two species out of one genus into a brand new genus and brought another species from another genus into the new genus. For the sake of brevity I’m leaving out some details that made the story even more fascinating. And I don’t have the space to summarize the rest of his presentation involving splitting another species of *Cerrophidion* and naming a new species of *Bothriechis*.

Robert concluded by speaking of the importance of systematics and taxonomy. He used a circular cladogram (worth a google) to emphasize that we know very little of the vast number of species sharing the planet with us. He stressed how meager our knowledge of a group of fairly prominent animals that have received at least some study over the years. If we don’t know that an animal exists we can’t determine its place in the world or its importance to us. He explained that taxonomy might have political consequences when people take pride in protecting a newly described species endemic to their land. He showed how a new species name can highlight environmental issues and raise awareness of environmental threats.

With humor and earnestness Robert described his adventures in systematics as he sifted through old literature, decanted preserved specimens, and pursued the living animals amidst spectacular scenery in order to add to our knowledge of snakes. He allowed us a glimpse into why this is exciting work and convinced us that it’s important work. He used cladograms and charts, photographs and drawings. He backed up his speaking talent with a delicious slide show. His mastery of PowerPoint was demonstrated as he answered questions at the end of his talk. Behind him pictures of vipers gradually faded into view, each viper occupying its respective branch on a cladogram until vipers filled the screen. I found myself thinking how important Robert’s and others’ work will be in avoiding those vipers fading from view. Thanks, Robert.

Unofficial Minutes of the CHS Board Meeting, July 18, 2014

President John Archer called the meeting to order at 7:35 P.M. Board member Jason Hood was not present.

Officers’ Reports

Recording Secretary: Erica Mede read the minutes of the June 13 board meeting, which were accepted as read. Due to the vacancy on the board for this position, Erica Mede agreed to take minutes at the board meetings until a new Recording Secretary is appointed.

Treasurer: Andy Malawy gave the financial report. Rich Lamszus asked if there was an allotment for Jr. Herpers. Andy confirmed that there is one present. Discussions on potential book and laptop purchases took place. Mike Dloogatch moved that board members be allowed to spend up to \$100 at their own

discretion so long as receipts are brought in. Motion was approved unanimously.

Membership Secretary: Mike Dloogatch read aloud the list of newly lapsed members.

Corresponding Secretary: Erica Mede talked about the letters she will be sending to various companies requesting raffle donations, and asked about the availability of letterhead stationery. Dick Buchholz can supply the stationery. The CHS received a sweet thank-you note from a girl scout troop.

Sergeant-at-arms: Dick Buchholz reported 46 in attendance at the June Show and Tell meeting.

Publications Secretary: Aaron LaForge said there was no update. John Archer asked Aaron to add a link to Friends of

Scales Reptile Rescue. Live streaming CHS general meetings and adding adoptions to the website were discussed. Mike D. requested information on the Midwest Herp Symposium be put onto the site as well. Dick B. also wants show dates to be added to the site to help keep our members up to date!

Committee Reports

Shows:

- Notebaert Nature Museum, first full weekend of each month.
- Museum of Science and Industry Members' Night, July 23.
- SEWERFest, August 3.
- Bug Fest, Red Oak Nature Center, Batavia, Illinois, August 23.
- Unity Fest, Marquette Park, Chicago, September 6.
- Westmont Pet Promenade, September 13.
- Meet the Creek, Kiwanis Park, Brookfield, September 20.

Adoptions: Linda Malawy informed the board that Colleen Schwarz will be working with her and potentially taking over Adoptions next year. Bob Bavirsha received a Blanding's turtle from Animal Welfare and brought it to the Wildlife Discovery Center where it was pit-tagged and IDNR was informed.

Junior herpers: John Archer declared Jr. Herpers an official committee. Erica Mede and Rich Lamszus will serve as chair and co-chair respectively. One of the adult volunteers wants to help Teresa Savino with the CHS library at Jr. Herper events. Rich said there were 52 in attendance at the last meeting. Mike Polinski will be working on interpreter guidelines for speakers. Erica said organization has become a priority.

Library: Teresa Savino is working on new books for the library. She expects several to arrive in the next few weeks. Teresa needs a stepladder. Mike D. will send Teresa a membership list so that she can e-mail reminders to those keep books checked out too long.

Herp of the month: July's theme is herping.

Old business

Columbus Zoo trip: Linda M. is still working out the details.

New Business

Bylaws revision: Board members, and all members of CHS are encouraged to read the bylaws for the organization (available on our website). The next several board meetings will focus on bringing them up to date.

CHS sponsored bus trip: Dick Buchholz suggested that the CHS might partially subsidize the cost of a bus for a future zoo trip to give families a chance to experience CHS together.

Board positions and committees: The board discussed adding, combining, and subtracting CHS officers. Suggested to make some officers into committees. Discussed adding an electronic communications committee and a field trip committee. Also discussed merging some of the secretarial positions.

Credit card readers: Erica M. helped Andy M. change the account numbers on our Square account. Aaron L. will look into ordering more Square Readers for the society.

Signs: John A. wants to look again into having signs created for the society. More discussion is needed as well as someone to do graphic design.

Social media: We need someone in charge of Twitter and Instagram accounts for the society.

E-mail sign up: Erica M. will be creating a sign-in sheet for folks to put their latest e-mails into our system so we can keep everyone up to date.

Awards committee: Dick Buchholz requested that the members-at-large help with the committee.

Round Table

Bob Bavirsha went out on a "gator call" only to find out they were tadpoles. Bummer.

Rich Lamszus reported his bold jumping spider babies are doing well.

Teresa Savino said that a Carolina beach is in her future!

Dick Buchholz will be missing the August board meeting.

Andy Malawy changed the Square and was very excited!

Roy Carlson informed us that today was the 3rd anniversary of the CHS Facebook page!

Erica Mede has begun painting her Boba Fett helmet.

Mike Dloogatch gave a shameless plug for Midwest Herp Conference on October 17.

Mike Polinski saw a turtle on fire on Facebook and was happy to hear they caught the person.

Ed Huether just adopted Nuna from Friends of Scales Reptile Rescue.

John Archer encouraged each board member to bring in at least one animal to general meetings.

The meeting was adjourned at 9:47 P.M.

Respectfully submitted by Erica Mede



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For sale: Standard 24" Neodesha reptile cages, 3 × 6" vent on top, tempered glass front. Like new condition, no burns or stains, original glass. These cages do not have the dam (horizontal molding that crosses the entire front width of the cage, used to hold back bedding material)—easier to clean without the dam. About 20 currently available, \$45 each. Linda Malawy, (630) 717-9955, linda_malawy@hotmail.com

For sale: High quality, all locally captive-hatched tortoises, all bred and hatched here in the upper Midwest. Baby leopards, Sri Lankan stars, and pancakes usually available, and are all well-started and feeding great! Leopards are \$125 ea., Sri Lankans (2012 hatched) \$475 ea. And Pancakes are \$195 ea. Leopards for out of state sale/shipping require a veterinary health certificate (inquire for cost). E-mail at KKkranz1@wi.rr.com or call Jim or Kirsten at 262 654 6303.

Herp tours: **Costa Rica herping adventures**. Join a small group of fellow herpers for 7 herp-filled days. We find all types of herps, mammals, birds and insects, but our target is snakes. We average 52 per trip, and this is our 10th year doing it. If you would like to enjoy finding herps in the wild and sleep in a bed at night with air-conditioning, hot water and only unpack your suitcase once, instead of daily, then this is the place to do it. Go to our web-site <http://hiss-n-things.com> and read the highlights of our trips. Read the statistics of each trip and visit the link showing photos of the 40 different species we have found along the way. E-mail at jim.kavney@gmail.com or call Jim Kavney, 305-664-2881.

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UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, August 27, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **Andy Snider**, curator of herpetology and aquatics at Brookfield Zoo, will be the featured speaker.

At the September 24 meeting **Colette Adams**, general curator at the Gladys Porter Zoo in Brownsville, Texas, will speak about conservation of the critically endangered Philippine crocodile (*Crocodylus mindorensis*).

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

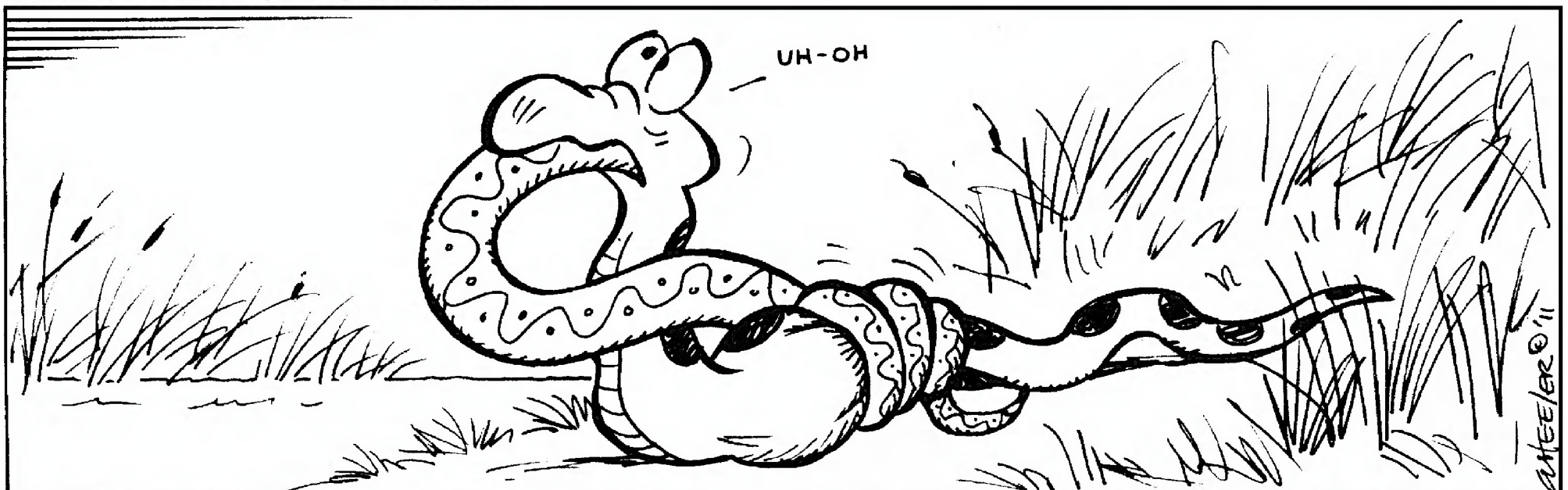
Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held at 7:30 P.M., September 12, at the home of Andy and Linda Malawy in Naperville. Please call Linda at (630) 717-9955 if you wish to attend.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the group's Facebook page.

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